

AMENDMENTS TO THE CLAIMS:

Please replace the claims with the claims provided in the listing below wherein status, amendments, additions and cancellations are indicated.

1. (Currently Amended) An image processing device for applying a certain process to input image data in accordance with gradation data of a plurality of color components for each pixel of an image represented by the input image data, comprising:

an unwanted gradation condition provider for providing a condition for determination of unwanted gradation for each of a plurality of color components;

an unwanted pixel determining unit ~~means~~ for determining ~~as to pixel by pixel~~ whether all the gradation data for each pixel of the image ~~of the plurality of~~ in regard to the color components ~~composing each one of the pixels of the input image data~~ satisfy ~~[[a]]~~ respective unwanted gradation ~~condition~~ conditions provided by the unwanted gradation condition provider ~~that is predetermined with respect to each one of the color components, the judgment being made pixel by pixel; and~~

an unwanted pixel gradation ~~conversion means~~ converter for converting, into a predetermined gradation, the gradation data of the plurality of color

components of the pixel having gradation data that ~~has~~ have been ~~judged~~ determined to satisfy the unwanted gradation conditions by the unwanted pixel determining unit ~~means into a~~, said predetermined gradation ~~which is~~ being set with respect to each one of the color components.

2. (Currently Amended) The image processing device according to claim 1, ~~further comprising~~ wherein said unwanted gradation condition provider includes an unnecessary image gradation determining unit for determining, for each of the color components, a gradation of an unnecessary image which is deemed to be unnecessary for reproduction, and a an unwanted gradation condition setting means for ~~determining~~ setting the unwanted gradation condition in accordance with the ~~a gradation condition of an unnecessary image data in the input image data to set the gradation condition as the unwanted gradation condition.~~

3. (Currently Amended) The image processing device according to claim 2, wherein said unnecessary image gradation determining unit is adapted to determine a gradation of ~~the unnecessary image data includes~~ an undertone portion in the image represented by the input image data as the gradation of the unnecessary image.

4. (Currently Amended) The image processing device according to claim 2, wherein said unnecessary image gradation determining unit is adapted to determine a gradation of ~~the unnecessary image data includes~~ an undertone portion and a backside image portion in the image represented by input image data as the gradation of the unnecessary image.

5. (Currently Amended) The image processing device according to claim 2, wherein said unnecessary image gradation determining unit is adapted to determine a gradation of ~~the unnecessary image data includes~~ a backside image portion in the image represented by the input image data as the gradation of the unnecessary image.

6. (Currently Amended) The image processing device according to claim 2, wherein ~~the unwanted gradation condition setter means includes an unnecessary image data gradation detecting means for detecting~~ said unnecessary image gradation determining unit is adapted to determine a gradation range of the unnecessary image data with respect to each one of the color components ~~based on~~ in accordance with ~~the~~ gradation data of the input image data to set the unwanted gradation condition.

7. (Currently Amended) The image processing device according to claim 6, wherein the unnecessary image data gradation ~~detecting means~~ determining unit includes a histogram providing unit for providing a histogram showing the number of pixels at each gradation as a frequency of gradation, with respect to each of the color components of the input image data, a frequency checker for checking the frequency of each gradation from a lower gradation, a gradation detector for detecting, in the histogram, ~~detects~~ a specific gradation that satisfies a predetermined detection condition with respect to each one of the color components, and a gradation range determining unit for determining ~~based on the gradation data of the input image data to determine~~ the gradation range of the unnecessary image data based on the detected gradation, ~~the detection being carried out by checking a frequency of the gradation from a lower gradation side in a histogram showing the frequency, number of pixels, vs. gradation with respect to each color component of the input image data.~~

8. (Currently Amended) The image processing device according to claim 7, wherein the unnecessary image gradation ~~detecting means~~ determining unit includes a smoothing processing unit for smoothing a curve in the histogram.

9. (Currently Amended) The image processing device according to claim 7, wherein the detection condition for the detection of the specific gradation is either (I) or (II) presented below:

(I) ~~under this condition~~, the specific gradation is given a gradation value at which a slope of a curve in the histogram shifts from negative to positive;

(II) ~~under this condition~~, the specific gradation is given a gradation value at which a change rate of a slope of a curve in the histogram shifts from negative to positive.

10. (Currently Amended) The image processing device according to claim 7, wherein the detection condition for the detection of the specific gradation is either (I), (II), or (III) presented below:

(I) ~~under this condition~~, the specific gradation is given a gradation value at which a slope of a curve in the histogram shifts from negative to positive;

(II) ~~under this condition~~, the specific gradation is given a gradation value at which a change rate of a slope of a curve in the histogram shifts from negative to positive;

(III) ~~under this condition~~, the specific gradation is given a gradation value at which a slope of a curve in the histogram is negative, and a ratio of the

frequency of the gradation value to a sum of the frequencies of the gradations lower than the gradation value is or is smaller than a predetermined value.

11. (Currently Amended) The image processing device according to claim 9, wherein the unnecessary image ~~data~~ gradation ~~detecting means~~ determining unit is adapted to set ~~sets~~, as a detection start gradation, a lowest gradation having a frequency exceeding a predetermined frequency ~~as a detection start gradation~~ and ~~starts~~ start detection of the gradation from the detection start gradation toward a higher gradation.

12. (Currently Amended) The image processing device according to claim 7, wherein the unnecessary image ~~data~~ gradation ~~detecting means~~ determining unit is adapted to set, as a detection start gradation, a lowest gradation having a frequency exceeding a predetermined frequency ~~as a detection start gradation~~ and judge ~~judges~~ whether a first detected gradation satisfies one of ~~[[the]]~~ conditions (I), (II), (III) and (IV) presented below when searching for a target gradation from the detection start gradation toward a higher gradation:

(I) ~~under this condition~~, the target gradation is given a gradation value at which a slope of a curve in the histogram shifts from negative to positive;

(II) ~~under this condition~~, the target gradation is given a gradation value at which a change rate of a slope of a curve in the histogram shifts from negative to positive;

(III) ~~under this condition~~, the target gradation is given a gradation value at which a slope of a curve in the histogram is negative, and a ratio of the frequency of the gradation value to a sum of the frequencies of the gradations lower than the gradation value is or is smaller than a predetermined value;

(IV) ~~under this condition~~, the target gradation is given a gradation value at which a distance from the detection start gradation value toward a higher gradation value is equal to or greater than a predetermined value.

13. (Currently Amended) The image processing device according to claim 7, wherein the unnecessary image data gradation determining unit detecting means ~~sets~~ is adapted to set, as the gradation range of the unnecessary image, a gradation range extending to a lower gradation from having an uppermost gradation lower than a first detected gradation which is detected first as satisfying the specific condition as the gradation range of the unnecessary image data when searching for the target gradation is searched for from a lower gradation side in the histogram.

14. (Currently Amended) The image processing device according to claim 7, wherein the unnecessary image data gradation ~~detecting means sets~~ determining unit is adapted to set, as the gradation range of the unnecessary image, a gradation range having an uppermost gradation lower than extending to a lower gradation from a second detected gradation which is detected at second times as satisfying the specific condition ~~as the gradation range of the unnecessary image data when searching for the target gradation is searched for~~ from a lower gradation side in the histogram.

15. (Currently Amended) The image processing device according to claim 7, wherein the unnecessary image data gradation ~~detecting means sets~~ determining unit is adapted to selectively sets set, as the gradation range of the unnecessary image, a gradation range having an uppermost gradation lower than extending to a lower gradation side from a first detected gradation or a gradation range extending to the lower gradation side from ~~having an uppermost gradation lower than~~ a second detected gradation ~~as the gradation range of the unnecessary image data, the first and second detected gradation being detected at first and second times respectively when searching for the target gradation is searched for~~ from ~~[[a]]~~ the lower gradation side in the histogram.

16. (Currently Amended) The image processing device according to claim 7, wherein the unnecessary image data gradation ~~detecting means~~ determining unit is adapted to respond to an input operation of an operator to selectively ~~sets~~ set, as the gradation range of the unnecessary image, a gradation range ~~having an uppermost gradation lower than~~ extending to a lower gradation side from a first detected gradation or a gradation range extending to the lower gradation side from having an uppermost gradation lower than a second detected gradation as the gradation range of the unnecessary image data, the first and second detected gradation being detected at first and second times respectively when searching for the target gradation is searched for from ~~[[a]]~~ the lower gradation side in the histogram.

17. (Currently Amended) The image processing device according to claim 1, wherein the ~~predetermined gradation is the lowest gradation outputtable by an image forming apparatus adapted to be electrically connected thereto~~ the unwanted pixel gradation converter is adapted to convert the gradation data satisfying the unwanted gradation conditions, into a lowest one of the gradations that can be output by the image processing device.

18. (Currently Amended) The image processing device according to claim 6, wherein the unwanted gradation condition ~~provider~~ ~~setter means controls the unnecessary image data gradation detecting means to detect~~ is adapted to determine, as a unwanted gradation threshold value for the determination of unwanted gradation, an upper limit of the gradation range determined by the unnecessary image gradation determining unit, the based on an upper limit of the gradation range of the unnecessary image data so as to set the unwanted gradation condition being that the gradation is such that the unwanted gradation is a gradation lower than the unwanted gradation threshold value.

19. (Currently Amended) The image processing device according to claim 7, wherein the unnecessary image data gradation ~~detecting means sets~~ determining unit is adapted to set, as the a gradation range for the unnecessary image, a range extending between having a lowermost gradation higher than a first detected gradation and an uppermost gradation lower than a second detected gradation as the gradation range of the unnecessary image data , the first and second detected gradations being detected at first and second times respectively when searching for the target gradation is searched for from a lower gradation side in the histogram.

20. (Currently Amended) The image processing device according to claim 19, wherein ~~the predetermined gradation includes a gradation of the data~~

concerning the unwanted pixel gradation converter is adapted to convert the gradation data satisfying the unwanted gradation conditions, into gradation data of an undertone in the input image data.

21. (Currently Amended) The image processing device according to claim 20, wherein the gradation data of ~~the data concerning~~ the undertone is ~~computed~~ determined based on the first detected gradation ~~when searching~~ which is detected first when for the target gradation is searched for from ~~[[a]]~~ the lower gradation side in the histogram.

22. (Currently Amended) The image processing device according to claim 18, further comprising:

an ~~adjusting~~ adjusted pixel determining ~~means~~ unit for judging whether a pixel having gradation data that does not satisfy the unwanted gradation condition with respect to at least one of the color components is an ~~adjusting~~ adjusted pixel that satisfies a certain adjusting gradation condition which is predetermined with respect to each one of the color components, the ~~judgement~~ judgment being made with respect to all the gradation data of the plurality of color components composing of the pixel; and

an ~~adjusting~~ adjusted pixel gradation ~~conversion means~~ converter for converting each one of the gradation data of the plurality of color components ~~composing of~~ the ~~adjusting~~ adjusted pixel into a gradation lower than ~~[[the]]~~ an original gradation of the ~~adjusting~~ adjusted pixel in the image represented by the input image data.

23. (Currently Amended) The image processing device according to claim 22, wherein the adjusting gradation condition ~~sets~~ is set such that the gradation ~~is~~ lower than a predetermined adjusting gradation threshold value.

24. (Original) The image processing device according to claim 23, wherein the adjusting gradation threshold value is determined based on the unwanted gradation threshold value.

25. (Currently Amended) The image processing device according to claim 23, wherein the ~~adjusting~~ adjusted pixel gradation ~~conversion means~~ converts converter is adapted to convert a gradation data of each one of the color components of each one of the ~~adjusting~~ adjusted pixels into a data of a gradation that is computed in accordance with the gradation in the image represented by the input image data, ~~based on~~ by means of a function of having parameters of the

unwanted gradation threshold value and the adjusting gradation threshold value as ~~parameters~~ with respect to each one of the color components.

26. (Currently Amended) The image processing device according to claim 23, wherein the ~~adjusting~~ adjusted pixel gradation ~~conversion means sets~~ converter is adapted to set a common gradation lowering rate and lower the gradations of adjusted pixels with the common gradation lowering rate which is common to all the color components, thereby adjusting the gradations of the adjusted pixels, with respect to each one of the adjusting pixels to convert gradation data of all the color components composing the adjusted pixel into a gradation that is lowered at a gradation lowering rate generally the same as the common gradation lowering rate with respect to the gradation of each one of the color components in the input image data.

27. (Currently Amended) The image processing device according to claim 26, further comprising:

a target color component setter ~~means~~ for setting, as a target color component, one of the plurality of color components of ~~composing~~ each one of the pixels of the image represented by the input image data ~~as a target color component~~, wherein

the ~~adjusting adjusted pixel gradation conversion means sets~~ converter is adapted to set the common gradation lowering rate with respect to each one of the adjusting pixels depending on the gradation of the target color component ~~in the input image data.~~

28. (Currently Amended) The image processing device according to claim 27, wherein the target color component setter ~~means sets~~ is adapted to set, as the target color component, a color component having a smallest distance relative to the adjusting pixel threshold value, among the plurality of color components composing each one of the ~~adjusting adjusted~~ pixels ~~as the target color component.~~

29. (Currently Amended) The image processing device according to claim 27, wherein the ~~adjusting adjusted pixel gradation conversion means computes~~ converter is adapted to determine the common gradation lowering rate in accordance with the gradations of the target color component of each adjusted pixel in the image represented by the input image data, by means of a function of having parameters of the unwanted gradation threshold value ~~as parameters~~ with respect to each one of the color components ~~with respect to each one of the adjusting pixels depending on the gradation of the target color component of each one of the adjusting pixels in the input image data, based on a function which is set by the~~

~~unwanted gradation threshold value and the adjusting gradation threshold value of the target component as parameters.~~